

# Soya beans

— Production guideline —



agriculture,  
forestry & fisheries

Department:  
Agriculture, Forestry and Fisheries  
REPUBLIC OF SOUTH AFRICA

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# *Soya beans*

— *Production guideline* —

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## GENERAL

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### Classification

Scientific name: *Glycine max*

Common name: *Soya bean, Greater bean*

### Origin and distribution

Soya beans are indigenous to Manchuria, China. The crop is considered one of the five oldest cultivated crops and was utilised by the Chinese as a source of food before 2500 BC. However, it was only discovered by the western world as a source of oil and protein in the 19th century. In the past 30 years, world production of soya beans increased to more than 100 million metric tonnes. Of this, 51% is produced in the USA, 20% in Brazil, 10% in Argentina and 10% in China. The first report of soya beans in South Africa is believed to be in the Cedara Memoirs of 1903.

According to the report, soya bean seeds were imported from China. However, germination was poor, plant developed fast and pods shattered prior to harvesting. Soya bean was also grown at the research station at Potchefstroom in the early fifties and a breeding line with good adaptation and resistance to shattering was released under the name Geduld. This was the most important variety up to the early 80s. Initially, soya bean production was limited to Bapsfontein and the northerly Lowveld areas, but gradually it became important in rotation with wheat in irrigation areas.



## Production levels in South Africa

Soya bean production in South Africa currently ranges from 450 000 to 500 000 tons per annum at an average yield of 2,5 to 3 t/ha under dry-land conditions. Out of all the provinces, Mpumalanga appears to be the one that produces the largest quantities of soya beans (about 42%). The Free State produces 22% of the total harvest, while KwaZulu-Natal produces 15%, Limpopo 8%, the North West 5% and Gauteng 2%.

## Major production areas in South Africa

Province	District	Towns
Mpumalanga	Gert Sibande	Morgenzon, Volkrust, Piet Retief, Perdekop
	Nkangala	Ermelo
	Mankaligwa	Secunda
Free State	Thabo Mofutsanyane Fezile Dabi	Bethlehem, Warden Villiers, Vrede
Kwa-Zulu Natal	Umgungundlovu Amajuba Zululand UMzinyathi eThekweni	Greytown Normandien Pongola, Vryheid Dundee Winterton, Bergville
Limpopo	Waterberg Sekhukhune	Koedoeskop, Naboomspruit Groblersdal, Marble Hall
North West	Ngaka Modiri Malema	Mafikeng, Delareyville, Lichtenberg, Zeerust
	Dr. Kenneth Kaunda	Potchefstroom Ventersdorp, Klerksdorp
	Bojanala	Rustenburg, Moretele, Koster, Brits
Gauteng	Metswedeng Sedibeng	Bapsfontein, Bronkorspruit Heidelberg/Nigel

## Cultivars

Soya bean cultivars are area-specific with regard to optional adaptation. The duration from planting to maturity should be approximately 120 to 130 days for a well-adapted cultivar. Where cultivars are planted at higher altitudes or latitudes than recommended; the growth period will be longer. There are several registered determinate and indeterminate cultivars in

South Africa with suitability varying according to regions or provinces. The cultivars also vary in their resistance to diseases, stressful weather conditions, weeds and other factors that affect production. Cultivars with a relatively long growing season should be considered when planting soya bean for fodder where much emphasis should be placed on vegetative growth rather than grain production. The seeds can be purchased from the registered seed suppliers in the country. In South Africa, more than 80% of the soya bean production is Roundup Ready cultivars, which can be obtained from various registered seed companies. When making a particular cultivar choice, producers should consider characteristics such as growth habit, shattering, pod height, resistance to pest, diseases and chemicals.

Conventional cultivars		GMO cultivars	
SNK 500 (24)	Mopanie (489)	PAN 538 RR (1412)	Phb 96B01 R (411)
Sonop (150)	Knap (150)	PAN 1583 R (1412)	Phb 95Y41 R (411)
Stork (254)	Tambotie (489)	PAN 1666 R (1412)	Phb 95Y40 R (411)
Maruti (305)	LS 678 (484)	LS 6164 R (484)	Phb 95Y20 R (411)
Dumela (305)	LS 677 (484)	LS 6161 R (484)	Phb 95B53 R (411)
Dundee (254)	LS 555 (484)	LS 6050 R (484)	
Jimmy (254)	PAN 626 (1412)	LS 6162 R (484)	
Kiaat (489)	PAN 809 (1412)	AS 4801 R (1076)	
Egret (254)	PAN 660 (1412)	AG 5601 (80)	
Mukwa (489)	PAN 1669 (1412)	A 5409 RG (80)	

## Plant description

### *Mature plant*

Soya bean grown for seed production is an annual, leguminous, warm-temperature, short-day plant, normally bushy and erect (upright growth habit). Usually plant height varies from 40 to 100 cm, plants are much branched with well-developed roots, and each plant produces a number of small pods containing one to four round, usually yellow to black seeds. It has a round hairy stem with branches, and it varies in color according to the cultivar. The plants are categorised into determinate and indeterminate types. The determinate types are of short and terminal growth with the onset of flowering and the growth tips end in a pod-bearing raceme. The harvesting can be done in one round because all pods usually ripen at the same time. The indeterminate types can grow to a height of about 70 cm. They continue to grow vegetatively, they flower and they form pods resulting in seeds or pods of different sizes that require manual harvesting at different times.

## *Roots*

The root system is extensive, with a tap root that may exceed 1, 5 m in length. The tap root has lateral roots within a soil depth of 300 mm. The roots have nodules containing a species specific strain of *Rhizobium japonicum* bacteria that causes the plant to fix nitrogen to the soil independently. The lateral root nodules are more important during flowering and seed formation.

## *Leaves*

Leaves are alternate, vary in shape, are hairy in some varieties, are normally trifoliate, with the three ovate or lanceolate leaflets borne on a long petiole, and they stipulate. The leaves can appear dark green or tinted with brown, red or blue lesions. Leaves are normally shed as the seed-pods ripen, which is a useful sign for mechanised harvesting. Leaves normally appear yellowish during this time.

## *Flowers*

Flowers are borne on short racemes originating in leaf axils, with each inflorescence bearing up to twenty small purple or white flowers that usually undergo self pollination. Bees can also be used as pollinating agents in the production of soya bean hybrids since it has been proved that bees can increase seed yield by 20%. In indeterminate types, flowering begins on the main stem at the fourth to eighth node and progress upwards with branches flowering some days later than the main stem. Determinate types flower at the eighth to ninth node and precede rapidly so that every node, including the branches and terminal raceme, flowers within a few days.

## *Fruit*

The fruits are short, hairy pods which vary in sizes, usually with some brown or black shade, which can be green, red or purple tinted. The pods usually contain three but occasionally smaller, hard, round or ovoid seeds, with smooth, shiny testa and small distinct hilum.



## *Seeds*

The seeds are typically round to oval with a mass varying from 12 to 25 g per 100 seeds. Seed colour can be yellow, green, red, brown, black, slightly mottled or occa-

sionally bi-coloured according to variety while hilum colour varies from colourless to black. Pale yellow is the most commercial acceptable colour for soya beans that are intended for human consumption and oil production. The seed consists of 17% to 22% oil and 36 to 42 proteins, which serve as nutrition in the developing seedling in the first two weeks of growth.



## Climatic requirements

### *Temperature*

Temperature plays an important role in determining the rate at which soya beans grow. Both high and below-optimum temperatures delay growth. Yields are adversely affected as temperatures rise above 30 °C, while temperatures below 13 °C for long periods during flowering stage inhibit flower and seed formation. Although 25 °C can be considered the overall optimum temperature for all growth stages, the response of the soyabean differs at various growth stages. At planting time, soil temperatures must preferably be in the region of 15 °C in order to stimulate germination.

Young seedlings are easily damaged by excessively hot weather conditions. Very cold and very warm temperatures delay flowering or lead to flower abortion. Day length influences soya bean growth (photo-period sensitivity), and different cultivars have specific daylight length requirements, meaning that a certain cultivar could be more or less restricted to a specific area.

### *Rainfall requirements*

Rainfall of 500 to 900 mm is required for better yields and better seed quality, depending on growth conditions. Because of its long root system, the soyabean can tolerate dry conditions prior to flowering but adequate moisture becomes essential once the buds are formed and until the pods have filled. Soya beans are susceptible to drought during the flowering and pod formation stages. They can also do well in warm, dry areas under irrigation. Excessive rainfall prior to and during flowering can result in luxuriant growth and increased lodging. Waterlogged conditions have a negative effect on the crop yield. Maximum seed yield is possible where water in the root zone is kept above 50% plant-available.

### *Soil requirements*

Deep, well-drained soil with a fine but firm seedbed that is high in fertility and has good water-holding capacity is needed for good soya bean yields. Soya beans are generally better adapted to heavier soils and better able to utilise water at lower soil depths than most other crops, including maize. Soya beans are better adapted to soil types with a lower pH than other legume crops, but a pH lower than 5, 2 impedes nitrogen fixation. Compacted soils should be avoided because the hypocotyl of the soya bean breaks easily during emergence if under pressure. It is preferable to plant in moist soil. Good seed-to-soil contact must be ensured and good emergence is critical and the formation of a soil crust at this time should be prevented.

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## CULTIVATION PRACTICES

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### Propagation

Propagation is through seed.

### Soil preparation

Soil preparation for soya beans must be done thoroughly to ensure a deep, loose seedbed. However, unnecessary tillage should be avoided because, besides being costly in terms of labour and money, every time soil is loosened, there will be a loss of moisture and soil structure. Soil must also be protected against loss through wind and water erosion—a concern that dictates the kind of tillage system and the time at which it is utilised.

Tillage for soya beans can be divided into two basic approaches, namely conventional tillage and conservation tillage. Conventional tillage normally involves inversion of the tilled surface layer, which leaves the soil surface virtually free of crop residues. Conservation tillage, on the other hand, uses tillage implements that leave most of the soil surface covered by crop residues following planting. Crop residues on the soil surface provide protection against wind and water erosion and also conserve soil moisture. Large clods, furrows or ridges must be avoided in order to ease planting operation and ensure a good plant stand. Herbicides are more effective in a fine, well-prepared seedbed.

### Field layout and design

The field should be free from water-logging, stone, excessive sand and weeds. The fields that were planted with leguminous crop in the same year

should be avoided. If the field has a steep slope, contours or ridges and waterways channels should be constructed.

### Planting date, spacing and plant density

Soya bean must preferably not be planted before mean daily temperatures of 15 °C to 18 °C have been reached. The planting date for soya beans is more critical than for maize, and it has a significant influence on vegetative growth because of the differences in day length between winter and summer. Planting date is important mainly because early plantings stimulate excessive vegetative growth which will later lead to lodging problems without any yield advantages. On the other hand, late plantings result in insufficient vegetative growth, a low pod height and lower yields. Planting date from early to mid-November is the most appropriate for optimum seed production in South Africa. In relatively warm areas where high temperatures enhance growth rate, planting as late as the end of December can still produce satisfactory yields.

Row width plays an important role in weed control, plant health and standability, and yield. Seed should be planted at a soil depth of 3 to 5 cm and should emerge within five to seven days after planting. Planting depth should be 2 cm in clay soil and 5 cm in sandy soil. Good seed-to-soil contact must be ensured for good emergence and the formation of a soil crust



should be prevented. The spacing between the rows can range from 40 to 90 cm and from 5 to 15 cm between the plants in the rows. The spacing can also be determined by the method of irrigation or water availability.

A population of 250 000 to 400 000 plants per hectare is generally recommended, depending on the yield potential of the area. The higher the yield potential of the area, the higher is the plant population. Planting on ridges can also increase yield. A population of fewer than 300 000 plants per hectare on average is recommended under dry climatic conditions, but a denser population than this is recommended under conditions of relatively high rainfall.

## Fertilisation

The nutritional requirements of soya beans are moderately high in comparison with other grains. Soya beans consume more phosphorus, potassium, magnesium and calcium than maize crops do. The soya bean plant has a strong tap-root system and is able to use nutrients in the subsoil very effectively. Rotation with other highly fertilised crops and seed inoculation lower the ratio of the nutrients to be added to the soil. Fertiliser should be placed 10 to 15 cm deep, below or to the side of the seed.

Soya beans do not respond as dramatically to band fertiliser as maize do, mainly because they are very sensitive to fertiliser burn, but they respond well to soil reserves that have built up over a long period through fertilisation of previous crops in rotation. However, where levels of fertiliser are very low, they must be applied prior to planting. Fertilisers can be also broadcast and ploughed into the root zone.

### *Nitrogen (N)*

The nitrogen requirement of soya bean is met from the action of nitrogen fixation in the root nodules, but care must be taken that the seeds are inoculated with the correct nitrogen-fixing bacterium, *Bradyrhizobium japonicum*, before planting. This enables plants not only to fix nitrogen to meet their own requirements, but also to carry over 30 to 50 kg of available nitrogen to the subsequent crop.

### *Phosphorus (P)*

Soya beans respond very well to phosphorus and continue to absorb it right up to the stage when the beans reach their full size. The phosphate requirement of soya bean is reduced and compound fertilisers are not

recommended if the soya bean is planted after well-fertilised crops, unless potassium is also required. Yield will be low if available phosphorus is less than 30 kg/ha. Very high soil phosphate values may depress seed protein and oil contents, or induce zinc and iron deficiencies.

In areas where no maize was grown, 40 kg/ha P<sub>2</sub>O<sub>5</sub> is required in the initial stage but less is required where fertilised maize was grown in the previous season. Single supers can be applied if potassium levels are desired. It should be banded 30 to 50 mm to the side of and below the seed.

### *Potassium (K)*

Soya beans require a large amount of potassium during vegetative growth, with the highest concentration in the stems and leaves. A similar level occurs in the pods and the potassium content of the seeds is initially higher than at maturity. Potassium must therefore be more easily accessible to plants during rapid growth than in seed formation. The soil analysis will help in determining the amount of fertiliser required for obtaining better yield.

### *Minor elements*

#### CALCIUM

Calcium improves the plant growth and yield on acid soils, and therefore it helps to correct the deficiency and maintain the balance between magnesium-potassium availability which is essential for growth. Calcium also enhances nitrogen fixation. The use of dolomitic limestone is essential where soil pH (KCL) is lower than 4,5–5,0.

#### MAGNESIUM

Soya bean is very susceptible to manganese deficiency, which frequently occurs on neutral or alkaline soils with a high pH, and plants remain stunted with yellowish leaves. The farmer can correct this by adding the required amount of manganese to other fertilisers or by spraying with manganese sulphate or oxide. Liming will be best to correct this deficiency.

#### SULPHUR

It is deficient in many tropical soils, and its deficiency results in a low seed yield despite adequate availability of nitrogen and phosphorus. It will be good to choose fertilisers with this nutrient, and therefore soya beans require it more than other grains do.

## OTHER ELEMENTS

Soya bean can benefit from a small application of several minor plant nutrients (cobalt and molybdenum), but it is important to establish the limiting plant growth factors before supplying them. Soil and foliar analyses can determine availability and uptake. Deficiencies can be corrected by seed dressing, fertiliser additives or foliar spray. Seed treatment with cobalt or molybdenum can slightly increase yields in cases where these trace elements are deficient, and may also reduce *Septoria* infections.

## Irrigation

Although soya beans require less water in the late reproductive growth stage, water is still essential for the translocation of nutrients from leaf and stem to the seeds. The method of irrigation will be determined by water availability, type of cultivar and the irrigation equipment available. The best methods are the sprinkler and drip irrigation. Irrigation systems are not 100% effective and more water must be applied to compensate for this deficit. Most soya beans are rainfed grown, the main factor limiting irrigation being profitability. In dry areas in underdeveloped countries, yield obtained under irrigation can be offset by drastically increased costs of production and aggravated where bulk and storage facilities are limited. Soya beans are sensitive to water shortage during the pod-set stage. Maximum seed yield is possible where water in the root zone is kept above 50% plant-available.

A substantial pre-planting irrigation which wets the soil from 60 to 100 cm is recommended and moderately large amounts at longer intervals are preferred to frequent small applications. Irrigation at planting or three to four days later stimulates rapid germination and prevents possible crust formation. Adequate moisture during flowering stage will ensure that the maximum number of flowers will be fertilised and will produce pods. Shortage of water during late grain-filling stage can reduce yields by as much as 30%.

## Weed control

Weeds can reduce yield, the degree of depression being related to the quantity of weeds and the growth stage of the crop. Young seedlings are unable to compete with many fast-growing weeds and their control at this stage is very important. Weeds usually have a fast growth rate and can easily deprive the soya bean plant of moisture, minerals and light during the early growth stage. Every effort should be made to control weeds before planting. Mechanical cultivation is less damaging once the plants are 5

to 10 cm high, although this should be done with judicious care to prevent soil from being thrown against the plant stems.

After six to eight weeks, soya beans can compete with all but the most persistent weeds, which may have to be removed by hand. Soya beans depend more on the vertical root than on the lateral root, thus over-deep weeding is not damaging in terms of yield reduction. The closer the soya bean spacing between the rows (30 cm spacing), the lower will be the weed depressions. The more sparsely the soyabean rows, the higher the depression by weeds.

Chemical control can also be used but it needs special attention because there can be a toxic interaction between herbicides/insecticides used in the previous season and those applied to the current crop. Soya beans are more sensitive to triazine-type herbicide and must not be planted in soil where the prescribed waiting period has not yet lapsed. Wide spectrums of soy bean herbicides are registered for pre-plant, pre-emergence and post-emergence application.

Roundup Ready Plus may be applied post-emergence to Roundup Ready soya bean cultivars from the ground-cracking stage through flowering. A minimum pre-harvest interval (withholding period) of 14 days is prescribed.

### Pest control

Insect pests of soya bean occur sporadically and can become economically important when large numbers build up. Regular inspections of the fields are necessary in order to facilitate the timeous identification of insect pests. Soya beans are susceptible to various insect pests, which have a negative effect on yield and on the quality of the grains. Insect control is necessary when pods are damaged. Certain soya bean cultivars are susceptible to root knot nematode; and the cultivation of these cultivars in soils with a high risk of nematode is not recommended. During the seedling stage, plants are attacked mainly by cutworms and large false wireworms. For the correct identification as well as effective control of insect pest infestations, the following publication can be consulted: "*Soybean Diseases and Pests*" by the ARC-Grain Crops Institute.

The following pests are some of the major insect pests in soya beans:

#### *Common cut worm*

- Larvae are usually dark grey to brown with a smooth, waxy appearance and are found at 20 to 50 mm under the soil surface.

It can be controlled chemically by using synthetic pytheroids; however, in order to be effective, the top 30 to 50 mm of soil must be moist.

#### *Large false wireworms*

- The larvae are 32 mm in length and 3,5 mm in radius and creamy white and their heads appear reddish brown because of bristles which protrude on the sides of the head.
- The larvae feed on seed, developing seedlings and stems of seedlings.

#### *Cabbage semi loopers*

- The larvae are blue-green and are up to 40 mm in length. They move with a characteristic doubling action.
- The larvae forage in the leaves of soya beans.

#### *Painted lady*

- The larvae of the painted lady are black with yellow lateral stripes and long body bristles and can reach a length of 30 mm.
- The larvae fold the leaf by spinning a web or attaching the leaf to the stem in this fashion.

#### *African bollworm*

- Larvae feed inside young and/or maturing pods with the posterior often protruding from the pod.
- Spraying with registered contact insecticides when pests are noticed usually ensures good control.

#### *American leaf miner*

- The larvae are small yellow maggots that tunnel and feed between the upper and lower surfaces of the leaves, causing brown regular patterns.
- They feed on the leaves and cause puncture marks on them.

#### *Aphids*

- These occur sporadically, particularly during warm, dry periods, and can be effectively controlled with the correct, registered insecticide.
- They are found in small colonies sucking sap from tender growth and they are a vector of a range of viruses on soya beans.

### *Thrips*

- These minute insects are less than 1 mm in length with four long, narrow, fringed wings. In immature stages they are yellowish in colour. Adults are dark-coloured and very active, with a habit of turning up the tip of the abdomen. In order to feed they rasp the plant surface causing small silverfish blotches.

### *Nematodes (various spp.)*

- These are microscopic, slender, transparent worms in the soil. They attack roots or tubers of plants causing lesions that make them susceptible to bacterial or fungal attack or cause knotty swellings on roots.
- Root knot nematodes constitute the greatest threat to soya bean production in South Africa.

### *Seed maggot*

- Seedlings collapse when still below surface, and maggots feed in germ shoots. It is particularly troublesome in cool moist soil that is very rich in decaying organic matter.
- Damaged plants and pods are more vulnerable to disease infection; therefore it is important that the following control measures are implemented timeously:
  - Crop rotation, e.g. maize-groundnut and tobacco-pigeon pea
  - Biological control
  - Cultivation of disease- and pest-resistant crops
  - Weed removal
  - Proper soil preparation
  - Inoculation with a cowpea group strain of rhizobium
  - Intercropping with cereals (sorghum, millet, cotton, maize, groundnuts, forage)
  - Avoidance of too much moisture or very humid conditions, especially during the flowering and harvesting period
  - Use of registered insecticides and pesticides/chemical control

### **Disease control**

Soya beans are susceptible to various viral and fungal diseases caused by different organisms. These diseases may result in low yield and poor

quality of the grains and should be controlled from soil preparation until harvesting in order to obtain better yields. Integrated mechanisms such as chemical, mechanical, biological and other cultural practices can be used to control the diseases. The soya bean production is affected by some of the following diseases:

#### *Soya bean rust*

- This is a fungal disease that is mainly spread by wind. New infections do not start from seeds but rather from windborne diseases. Infected leaves usually turn yellow and will keep falling prematurely.
- Symptoms are usually only seen post-flowering. Fungicides from triazole chemical group are very effective in controlling soya bean rust.

#### *Bacterial blight*

- This is particularly prevalent during wet conditions and when diseased plant residues have not been incorporated properly.
- Leaves of infected plants develop small yellow spots and drop early.

#### *Sclerotinia stem*

- It is a fungal disease that is characterised by sudden wilting and death of the plant, usually after flowering.
- A coarse white fungal growth can be seen on the roots or lower parts of the stem when the infected plant is pulled out of the ground.

#### *Purple seed stain*

- This is characterised by pink to purple discolouration of the seed, is normally caused by a fungus and occurs under wet conditions. Planting infected seed can result in seedling blight.

#### *Soya bean disease control measures*

- Use of disease-free and certified seeds
- Practicing crop rotation
- Applying scheduled irrigation
- Use of disease-resistant cultivars
- Deep ploughing
- Working in plant debris after harvesting
- Application of registered herbicides

## Cultivation practices

Cultivation practices that reduce the severity of the diseases depend on the disease-causing organisms and vectors, and the interactions between these organisms and the soya bean plant. Cultivation practices that produce vigorous plant growth reduce losses from most of the diseases. An effective crop practice is crop rotation.

### Harvesting

#### *Harvest maturity*

A delay in harvesting soya beans can result in serious loss due to shattering. Harvesting should commence when most of the leaves have been shed and the moisture content of the seed falls below 15% but while the stems are still pliable. This can be done through moisture testing. Otherwise, experienced producers can detect maturity by the colour of the pods and the shattering ability. When soya beans are ready for harvesting, pods will turn brown and shatter easily and the kernels will not yet be dry enough to break.

Pods normally shatter when ripe, releasing the seeds, the rate and degree of shattering being varietal characteristics, and early or high shattering characteristics are detrimental in types harvested mechanically.

#### *Harvesting methods*

Soya beans are not suited to hand harvesting, stacking or wind rowing. The recommended harvesting method is to use a combine fitted with a



soya bean or wheat table. Self-propelled combines with a reasonable capacity should be able to harvest 14 hectares a day. When combining soya beans, a slow drum speed (450-500 revolutions per minute) is required. The concaves must be set wider than for wheat and a slow ground speed (approximately 6 km/h) must be used. The faster the drum speed, the more splits will occur. To further minimise losses, the combine must be adjusted as low as possible. The combine must cut the plants as close to the soil surface as possible in order to minimise the number of pods left behind. The maturity period is fairly short and the availability of the harvesting equipments is therefore crucial, especially when unfavourable weather conditions may be expected during the harvesting period.

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## POST-HARVEST HANDLING

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### Sorting

After the soya beans are harvested they must be sorted for the purpose of removing foreign materials and unwanted seeds.

### Grading

There is only one class of soya bean for exports, namely Class SB, and therefore soya bean for class SB shall be graded as Grade SB1. Grade SB1 soya bean –

- (a) must be free from musty, sour, khaki-bush or other undesired odour;
- (b) must be free from glass, metal, coal or dung;
- (c) must contain no more noxious seeds than permitted in terms of the Foodstuffs, Cosmetics and Disinfectants Act (No. 54 of 1972);
- (d) must be free from live insects irrespective of whether such insect occur in, on or among the soya beans, in or on bags containing soya beans or in or on a bulk container (however, a consignment which is rejected owing to insect infestation may be presented for inspection again after fumigation with prescribed remedies, and in accordance with acknowledged methods);
- (e) must be free from a substance that renders it unfit for human or animal consumption or for processing into or utilisation thereof as food or feed;
- (f) must contain no chemical residues in excess of the prescribed maximum residue limit (However, if the prescribed maximum residue limit

of an importing country is lower than is permissible in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 36 of 1947), the prescribed maximum residues limit of the importing country must be complied with. Also, the Executive Officer may grant permission for soya beans with higher maximum residue limit to be exported to countries where this higher residue limit is permissible provided that the export documents are accordingly endorsed with the name of the importing country.)

- (g) must have a moisture content of not more than 13 per cent;
- (h) may comply with the requirements for declared plant injurious organisms of phytosanitary importance as determined by the Senior Manager: Plant Health/South African Agricultural Food, Quarantine and Inspection Services; and
- (i) must not exceed the maximum percentage of permissible deviation as determined in Table 1, Annexure A, of the Agricultural Product Standards Act, 1990, for the grade.

### Packaging

- Soya beans of different classes, subclasses and grades must be packed in different containers.
- Bags must be properly closed.
- Each container or the accompanying export documents of a consignment of soya beans must be endorsed with –
  - (a) the name of the product;
  - (b) the class, subclass and grade of the soya bean;
  - (c) the name and address of the exporter or the packer (if the name and address concerned are indicated in a code, this code must be registered with the Executive Officer);
  - (d) the country of origin (but no abbreviation nor the expression “South Africa” on its own may be used);
  - (e) the producer’s code or the silo code that is registered with the Executive Officer by the producer, exporter, packhouse, as the case may be (However, if a producer has more than one farm, each farm must be registered separately. Also, such code must be preceded by the expression “producer”, “silo”, “packer”, “PUC” or “FBO”, as the case may be, or any other suitable term having a similar meaning.)

### *Prohibited particulars*

No wording, illustration or other device of expression which constitutes a misrepresentation or which directly or by implication creates a misleading impression of the contents may appear on a soya bean container.

### **Storage**

- A container, excluding a ship's hold, railway truck or road truck and storage facility, which contains soya beans intended for export must be suitable, intact (excluding holes made by a grain probe in the case of bags), clean, dry and odourless.
- Subject to the provision of sub-item (1), a bag which contains soya beans intended for export must –
  - (a) be new;
  - (b) be strong enough for the conveyance of the maximum mass of soya beans that can be accommodated in that bag; and
  - (c) not be stained by any colouring matter or be impregnated by any liquid capable of imparting stains, excluding normal discolouration because of exposure to the sun.
- A ship's hold into which soya beans intended for export is released, must –
  - (a) apparently be free from insects; and
  - (b) reasonably be free from pieces of grain or any other material that may harbour insects.
- A storage facility or a railway truck or road truck must –
  - (a) apparently be free from insects; and
  - (b) reasonably be free from pieces of grain or any other material that may harbour insects. (However, an inspector may order the exporter or an agent to clean, treat or fumigate a contaminated storage facility or railway truck or road truck.)

Soya beans can be stored for a long period without fumigation. Owing to the inherent growth inhibitor in raw soya beans, insects are not inclined to attack them. Care must be taken to ensure that moisture does not converge, because it may lead to combustion. Air movement through the grain volume is useful to maintain a low temperature.

### **Transport**

Soya beans are transported by using ships, railway trucks or road trucks.

## Marketing

There is a growing interest in soy products in South Africa because of the health benefits attached to them. Soya bean consumption in the country is estimated at 25% for oil and oil cake, 60% for animal feed and 20% for human consumption. The marketing of soya beans has moved away from single-channel marketing to a free market system. The system complies with a free market economy, where the producer markets his own product to his own advantage, thereby also accepting the risks accompanied with the system.

The main influences on soya bean prices include the rate of increase in South American soya production, the Chinese demand for imported soya, marine freight rates, the strengthening of the rand/dollar exchange rate and the spread of the genetically modified cultivars in the main production areas. An increase in GMO cultivars could increase yields and help stabilise prices.

The Oilseeds Board terminated its functions and was replaced by the Oil and Protein Development Trust, which coordinates the marketing of oilseed crops. However, producers remain responsible. The era of a comprehensive world economy and the accompanying information technology has arrived, and therefore producers should make their own decisions in order to be economically competitive. It is, however increasingly difficult to make accurate predictions regarding future events, as our borders and markets have become so much larger.

The soya bean industry is also influenced by competitive imports. This implies that the local price will be derived from the international price of oil seeds and products. The international price and rate of exchange determine the local price, as this represents the price the buyer would be prepared to pay for the local product at the same point of delivery. As applies to other grain crops, producers and processors of soya beans must monitor the development of the local crop, rand/dollar exchange rates as well as the international and local markets, prior to making marketing decisions.

The local price of soya beans is derived from world price levels of oil seed products and if a net local deficit applies, large quantities of these products must be imported. The largest price determinant, however, is the international price level of oil and oil cake. Because of the fluctuation of world prices, one can expect the trading of locally produced oil seeds to be increasingly linked to international prices. The biofuel industry will also open doors for the soya bean market.

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## PRODUCTION SCHEDULES

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Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation										■	■	
Planting												■
Fertilisation	■	■										■
Irrigation	■	■										
Pest control	■	■										■
Disease control	■	■							■	■	■	■
Weed control	■	■								■	■	■
Leaf sampling	■											■
Harvesting		■	■	■								
Marketing	■	■	■					■	■	■	■	■

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## UTILISATION

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Human consumption: Seeds furnish one of the world's most important sources of oil and protein. Unripe seeds are eaten as vegetable and dried seeds are eaten whole, split or sprouted. The beans can be processed into soy milk, a valuable protein supplement in infant feeding which also provides curds and cheese. Soy sauce is made from the mature fermented beans, and soy is an ingredient in other sauces as well. Roasted seeds are used as a coffee substitute. The highly nutritious sprouts are readily consumed in Asia. Seeds yield edible, semi-drying oil, used as salad oil and for manufacturing margarine and shortening.

Whole soya beans can be processed into full-fat flour with about 20% oil, mechanically pressed meal provides low-fat flour with 5% to 6% oil, and solvent-extracted meal gives defatted flour with about 1% oil. The flour is used in bakery and other food products and as additives and extenders for cereal flour and meat products, as well as health foods.

**Industrial uses:** Oil is used industrially in the manufacturing of paints, linoleum, oilcloth, printing inks, soap, insecticides, and disinfectants. Lecithin phospholipids are obtained as a by-product of the oil industry and are used as a wetting and stabilising agent in the food, cosmetic, pharmaceutical, leather, paint, plastic, soap, and detergent industries. Meal and soy bean protein are used in the manufacturing of synthetic fibre, adhesives, textile sizing, waterproofing, fire-fighting foam and for many other purposes. The straw can be used to make paper stiffer than that made from wheat straw.

**Animal feed:** Soya bean oil cake is the most important protein component of the South African animal feed industry. The larger consumer of protein rich meal in South Africa is represented by the poultry industry, especially the broiler industry, which has a high demand for quality protein. Soy meal is a very rich protein feed for livestock and there is an increasing demand for it. The vegetative portions of plants are used for silage, hay, pasture or fodder, or may be ploughed back into the soil as a green manure.

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## NOTES



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